Classifying diseases and remedies in ethnomedicine and ethnopharmacology

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Abstract: ETHNOPHARMACOLOGICAL RELEVANCE: Ethnopharmacology focuses on the understanding of local and indigenous use of medicines and therefore an emic approach is inevitable. Often, however, standard biomedical disease classifications are used to describe and analyse local diseases and remedies. Standard classifications might be a valid tool for cross-cultural comparisons and bioprospecting purposes but are not suitable to understand the local perception of disease and use of remedies. Different standard disease classification system exist but their suitability for cross-cultural comparisons of ethnomedical data has never been assessed. Depending on the research focus, (I) ethnomedical, (II) cross-cultural, and (III) bioprospecting, we provide suggestions for the use of specific classification systems. MATERIALS AND METHODS: We analyse three different standard biomedical classification systems (the International Classification of Diseases (ICD); the Economic Botany Data Collection Standard (EBDCS); and the International Classification of Primary Care (ICPC)), and discuss their value for categorizing diseases of ethnomedical systems and their suitability for cross-cultural research in ethnopharmacology. Moreover, based on the biomedical uses of all approved plant derived biomedical drugs, we propose a biomedical therapy-based classification system as a guide for the discovery of drugs from ethnopharmacological sources. RESULTS: Widely used standards, such as the International Classification of Diseases (ICD) by the WHO and the Economic Botany Data Collection Standard (EBDCS) are either technically challenging due to a categorization system based on clinical examinations, which are usually not possible during field research (ICD) or lack clear biomedical criteria combining disorders and medical effects in an imprecise and confusing way (EBDCS). The International Classification of Primary Care (ICPC), also accepted by the WHO, has more in common with ethnomedical reality than the ICD or the EBDCS, as the categories are designed according to patient's perceptions and are less influenced by clinical medicine. Since diagnostic tools are not required, medical ethnobotanists and ethnopharmacologists can easily classify reported symptoms and complaints with the ICPC in one of the "chapters" based on 17 body systems, psychological and social problems. Also the biomedical uses of plant-derived drugs are classifiable into 17 broad organ- and therapy-based use-categories but can easily be divided into more specific subcategories. CONCLUSIONS: Depending on the research focus (I-III) we propose the following classification systems.

DOI: https://doi.org/10.1016/j.jep.2015.08.051

Originally published at:
Staub, Peter O; Geck, Matthias S; Weckerle, Caroline S; Casu, Laura; Leonti, Marco (2015). Classifying diseases and remedies in ethnomedicine and ethnopharmacology. Journal of Ethnopharmacology, 174:514-519.
DOI: https://doi.org/10.1016/j.jep.2015.08.051

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PII: S0378-8741(15)30118-5
DOI: http://dx.doi.org/10.1016/j.jep.2015.08.051
Reference: JEP9716

To appear in: *Journal of Ethnopharmacology*

Received date: 18 March 2015
Revised date: 21 August 2015
Accepted date: 29 August 2015

Cite this article as: Peter O. Staub, Matthias S. Geck, Caroline S. Weckerle Laura Casu and Marco Leonti, Classifying Diseases and Remedies i Ethnomedicine and Ethnopharmacology, *Journal of Ethnopharmacology* http://dx.doi.org/10.1016/j.jep.2015.08.051

Classifying diseases and remedies in ethnomedicine and ethnopharmacology

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Abstract

Ethnopharmacological relevance: Ethnopharmacology focuses on the understanding of local and indigenous use of medicines and therefore an emic approach is inevitable. Often, however, standard biomedical disease classifications are used to describe and analyse local diseases and remedies. Standard classifications might be a valid tool for cross-cultural comparisons and bioprospecting purposes but are not suitable to understand the local perception of disease and use of remedies. Different standard disease classification system exist but their suitability for cross-cultural comparisons of ethnomedical data has never been assessed. Depending on the research focus, (I) ethnomedical, (II) cross-cultural, and (III) bioprospecting, we provide suggestions for the use of specific classification systems.

Materials and methods: We analyse three different standard biomedical classification systems (the International Classification of Diseases (ICD); the Economic Botany Data Collection Standard (EBDCS); and the International Classification of Primary Care (ICPC)), and discuss their value for categorizing diseases of ethnomedical systems and their suitability for cross-cultural research in ethnopharmacology. Moreover, based on the biomedical uses of all approved plant derived biomedical drugs, we propose a biomedical therapy-based classification system as a guide for the discovery of drugs from ethnopharmacological sources.

Results: Widely used standards, such as the International Classification of Diseases (ICD) by the WHO and the Economic Botany Data Collection Standard (EBDCS) are either technically challenging due to a categorization system based on clinical examinations, which are usually not possible during field research (ICD) or lack clear biomedical criteria combining disorders and medical effects in an imprecise and confusing way (EBDCS).

The International Classification of Primary Care (ICPC), also accepted by the WHO, has more in common with ethnomedical reality than the ICD or the EBDCS, as the categories are designed according to patient's perceptions and are less influenced by clinical medicine. Since diagnostic tools are not required, medical ethnobotanists and ethnopharmacologists can easily classify reported symptoms and complaints with the ICPC in one of the "chapters" based on 17 body systems, psychological and social problems. Also the biomedical uses of plant-derived drugs are classifiable into 17 broad organ- and therapy-based use-categories but can easily be divided into more specific subcategories.

Conclusions: Depending on the research focus (I-III) we propose the following classification systems:

I) Ethnomedicine: Ethnomedicine is culture-bound and local classifications have to be understood from an emic perspective. Consequently, the application of prefabricated, "one-size fits all" biomedical classification schemes is of limited value.

II) Cross-cultural analysis: The ICPC is a suitable standard that can be applied but modified as required.
III) Bioprospecting: We suggest a biomedical therapy-driven classification system with currently 17 use-categories based on biomedical uses of all approved plant derived natural product drugs.

Keywords: Emic/etic, biomedicine, ethnomedicine, classification, diseases, standards

1. Introduction

Many ways exist to analyse ethnographic field-data. The selection of the most appropriate methodology depends on the focus of a study and the research questions. Usually, at a certain stage of the project, collected data are categorized for an overview and further analysis. Ellen (2006, p. 31) argued that "we cannot think about the world unless we assign it to categories". Any object or cultural trait can be classified according to different criteria. For instance, a car can be classified based on its colour, engine-power, number of seats or maximum speed. Also cultural traits can be classified according to a variety of parameters. Remedies, for example, can be classified according to body-system disorders and/or the symptoms against which they are indicated, the mode of application, the philosophical-therapeutical frame, organoleptic properties, mode of preparation, availability, and more. Classifying remedies into organ- and symptom-defined categories has a historic legacy. For example, Renaissance physician Matthioli [1501-1578] grouped all therapeutics in his augmented edition of Dioscorides' [1st century AD] *De Materia Medica* based on body parts, symptoms and therapeutical effects, beginning with the head and ending with laxatives and emetics (Matthioli, 1968-1970, 6th book).
A central objective in ethnopharmacological research is to understand and experimentally assess ethnomedical systems and their medicinal products (Leonti and Weckerle, 2015). With respect to ethnopharmacological field-studies, classification of medicines into use-categories helps to get an overview of the therapeutical diversity. When the numbers of individual use-reports are considered, such classifications can be used as a proxy for estimating the epidemiological situation, i.e. the preponderance of diseases and afflictions within a community.
However, culture defines medicine and disease etiologies vary between ethnomedical systems. For example, the manifestation of anxiety disorders has been shown to be heavily influenced by the sociocultural context (Hofmann and Hinton, 2014). Also effectiveness of medicines and treatments relate to disease etiologies and depend on the sociocultural context (Etkin, 1988). Thus specific cultural context influences illness experience, expression and responses to therapeutic interventions (Nichter, 1992, pp.: 223-259). Therefore, the emic perception and categorization of illness has to be understood for the development of meaningful use categories and a culturally appropriate classification system (Heinrich et al., 2009). The emic perspective is generally understood to come from within a culture and is opposed to the etic point of view, which is that of an outsider (e.g., a researcher). However, in practice this dichotomy is not static but can be viewed as stages in a dialectic intercourse (see e.g. Headland, 1990; Hickerson, 1992).
Disease concepts and etiologies can be assessed qualitatively through interviews and participant observation, while more or less coherent groups of remedies can help in demarcating and visualizing emic categories. The Sierra Popoluca people of southern Mexico, for instance, use the same plant-based remedies to treat fever and headache and *vice versa*, applying them in the same way, i.e. as a body shower. The Popoluca informants generally cited these symptoms together, in the same context. Therefore the emic Popoluca perspective is best reflected with a use-category including fever *and* headache (Leonti et al., 2001). Categorizing the associated use-reports and plant taxa separately, firstly as "fevers" or "infections" and a second time as "analgesics" or "headaches", would not reflect the emic perception and would thus not reflect the appropriate cultural context.
Appropriate use-categories and classification systems also allow for cross-cultural comparisons.

While classification systems based on emic use categories may show considerable overlap for geographically proximate and culturally related ethnic groups (e.g. Heinrich et al., 2014), emic use categories of unrelated cultures show poor congruence and might not be suitable for cross-cultural comparative analysis. This would suggest the need for a different approach to compare use-categories between culturally distinct ethnic groups. Generally, biomedically defined standard disease classifications such as the International Classification of Diseases (ICD) by the WHO or the Economic Botany Data Collection Standard (EBDCS) are used to define use-categories in cross-cultural comparisons.

2. Problem statement

To the best of our knowledge, the suitability of the International Classification of Diseases (ICD) and the Economic Botany Data Collection Standard (EBDCS) for ethnopharmacological and ethnomedical research has never been assessed or discussed in a broader scientific context, although they are widely used. However, what we have come across is a self-evaluation by the Economic Botany Subgroup of the Taxonomic Databases Working Group (TDWG) revealing that those who were not implementing the EBDCS were discouraged "finding the printed version cumbersome and difficult to interpret" (Daphne, 2002). Here, the limitations of the currently used biomedical classification systems for cross-cultural analyses in ethnomedicine and ethnopharmacology are addressed, and an alternative classification system accepted by the WHO, the International Classification of Primary Care (ICPC), presented. Since classification systems and use-categories may also be used as a starting point for selecting remedies for laboratory work, we also introduce a biomedicine informed classification, which applied as baseline data can help to guide drug discovery from ethnomedical sources.

3. The International Classification of Diseases (ICD) and its limitations for ethnomedicine and ethnopharmacology

The International Classification of Diseases (ICD) by the WHO (http://www.who.int/classifications/icd/en/) distinguishes over 20 different categories. The purpose of the ICD is to be used as a standard diagnostic tool in epidemiology, as defined by the WHO on its website:

"The International Classification of Diseases (ICD) is the standard diagnostic tool for epidemiology, health management and clinical purposes. This includes the analysis of the general health situation of population groups. It is used to monitor the incidence and prevalence of diseases and other health problems, providing a picture of the general health situation of countries and populations".

The structure of the ICD is disease based and has been developed for hospital data systems and is dependent on a precise diagnosis (Users Guide ICPC-2 Plus, 1998). This latter aspect makes it unpractical for ethnopharmacological research, as field-workers do not have the necessary diagnostic devices at their disposal. Moreover, most fieldwork is directed towards the recording of past experiences and events, making diagnostic examinations impossible. The accounts of the informants and the descriptions of medicines do not allow for detecting the causative agent or the etic disease etiology, which would be the basis for the use of the WHO classification system. It is thus difficult if not impossible to apply the ICD to ethnomedical records. Therefore, although the WHO's International Classification of Diseases is an excellent guide for explaining how clinical medicine classifies and distinguishes diseases from symptoms, its practical application for ethnopharmacologists and ethnobotanists is limited.

4. The "Economic Botany Data Collection Standard" (EBDCS) and its limitations for ethnomedicine and ethnopharmacology

The so-called "Economic Botany Data Collection Standard" (EBDCS) largely follows the ICD but lacks its diagnostic rigor. It was proposed by Cook (1995) and results from "discussions at the International Working Group on Taxonomic Databases for Plant Sciences (TDWG) between 1989 and 1992" and "provides a system whereby uses of plants (in their cultural context) can be described, using standardized descriptors and terms" (http://www.kew.org/tdwguses/).

Besides the lack of a proper clinical or pharmacotherapeutical basis, the EBDCS is a mixed classification system with heterogeneous use-categories, which in some cases adhere to the ICD, and in others combine both disorders and medical effects in a rather imprecise and confusing way. For example, chilblains and frostbites are filed under "muscular-skeletal system disorders" and the use-category "injuries" subsumes abscesses, bites, blisters, burns, wounds and bruises as well as cerebrovascular haemorrhage. Sunburns, however, are classified under "skin/subcutaneous cellular tissue disorders". Furthermore, the EBDCS proposes "inflammation" as a separate use-category, although inflammation is a symptom associated with different kinds of pathologies ranging from oncological diseases, through autoimmune diseases to all kinds of infections. Including "social uses" as another, separate use category, also makes little sense, as all medicinal uses are "social" by their very nature.

Remarkably, Gruca et al. (2014) suggested that "cultural diseases and disorders", which they also refer to as "culture-bound syndromes", and occasionally are referred to as "folk illnesses" (Browner et al., 1988) should be included as a separate medical category in the EBDCS. They suggest that this would "give a more accurate insight into traditional medicine". As examples for "culture-bound syndromes" the authors cite amongst others "susto" ("fright"; also "espanto") and "evil eye" (Gruca et al., 2014). These are emotional states, which are treated with medicinal plants but frequently also with rituals and ceremonies (Foster and Anderson, 1978; pp. 65-67, Quinlan, 2010). According to Foster (1951) "a sudden shock, and unexpected encounter with supernatural beings, a fall, or […] fear of death from purely natural causes" may cause "espanto". If the illness is believed to be caused by spiritual entities such as deities, gods, ghosts, ancestors, or demons, or by spells and black magic, diagnoses are often accompanied by oracles or spiritual sessions involving ritual specialists and healers (Foster and Anderson, 1978). In cases where the cause of illness is attributed to the material world, such as injuries, the diagnosis adhere more to the visible and observable universe. A strict dichotomy does not exist and healing ceremonies appeasing nature gods might be involved in both, personalistic and naturalistic etiological systems (Foster and Anderson, 1978). However, there exists a variety of "cultural syndromes" associated with the manifestation of psychological distress across cultures (Nichter, 2010), which biomedicine would diagnose as "nervousness", "stress", "mental illnesses" or "depression" (Quinlan, 2010; Foster and Anderson, 1978). Consequently, lab-based ethnopharmacologists screen plants used against e.g. "susto" for their influence on anxiety disorders (Bourbonnais-Spear et al., 2007). According to the EBDCS such reports would need to be classified as "mental disorders".

However, not all cultural syndromes are associated with the psychological equilibrium of humans. For example, Berlin et al. (1993) revealed that the Tzeltal and Tzotzil Maya ethnomedical syndrome "Me' winik" (palpitating mass around mid abdomen) corresponds to the biomedical equivalent of gallbladder diseases, which according to EBDCS should be categorized under "Digestive System Disorders".

In the light of the above, the inclusion of "culture bound syndromes" or "cultural diseases and disorders" into the EBDCS is not necessary: Firstly, psychological disorders are already included under the EBDCS category "mental disorders" (http://www.kew.org/tdwguses/rptLevel1_2States.htm), and secondly, classification mainly relies on symptoms rather than the etiology of diseases and many of the so-called "cultural diseases and disorders" can therefore be classified in biomedical categories. Last but not least "culture-bound

syndromes" is a rather out-dated term as every aspect related to health and illness is culture-bound (e.g. Etkin, 1988; Nichter, 2010).

5. International Classification of Primary Care (ICPC) and its limitations for ethnomedicine and ethnopharmacology

An alternative classification system accepted by the WHO is the International Classification of Primary Care (ICPC; http://www.who.int/classifications/icd/adaptations/icpc2/en/). The ICPC is an empirically designed tool created to classify patient data using the concept of "episodes of care" (Soler et al., 2008). The ICPC was designed by the ICPC working Party and published by WONCA (World Organization of National Colleges, Academies and Academic Associations of General Practitioners/Family Physicians) in 1987. The ICPC allows the classification of the three crucial elements of the health care encounter: (i) reasons for encounter, (ii) diagnosis or problems and (iii) process of care (Miller et al., 2009). The ICPC is intended for the use of primary health professionals such as primary care physicians, general practitioners and family physicians providing first-time consultation to patients within a health care system. It is a tool for monitoring and analysing epidemiological data and can be used to inform health services and health economics (User Guide ICPC-2 Plus, 1998). The concept of the ICPC induced a paradigm shift in family practice, away from the practitioner centred view. According to the ICPC approach, the patient's reason for seeking medical help, that is, the presentation of a health problem or disease to a health care provider, should be at the centre of the classification, rather than the diagnosis made by a medical doctor (Lamberts and Wood, 2002; Soler et al., 2008).

The ICPC has a biaxial structure with 17 chapters on one axis (15 are based on body systems, one concerns psychological problems and one social problems) and 7 components on the other axis (Table 1; Miller et al., 2009):

The 17 chapters are: **A**) General and unspecified; **B**) Blood, blood forming organs, lymphatics and spleen; **C**) Digestive; **D**) Eye; **E**) Ear; **F**) Circulatory; **G**) Musculoskeletal; **H**) Neurological; **I**) Psychological; **J**) Respiratory; **K**) Skin; **L**) Endocrine, metabolic and nutritional; **M**) Urology; **N**) Pregnancy, childbirth and family planning; **O**) Female genital system and breast; **P**) Male genital system; and **Q**) Social problems;

The 7 components are: **1**) Symptoms and complaints; **2**) Diagnostic, screening and preventive procedures; **3**) Medication, treatment and procedures; **4**) Test results; **5**) Administrative; **6**) Referrals and other reasons for encounter; and **7**) Diagnosis and diseases (Table 1; Miller et al., 2009).

In an ethnomedical context the ICPC components **2**) "Diagnostic, screening and preventive procedures" and **7**) "Diagnosis and diseases" depend on the cultural (emic) disease etiology system and can be compared qualitatively. The ICPC components **4-6** are not intrinsically part of ethnomedical systems but through biomedical health care providers test results (**4**), such as diagnosis of diabetes and infectious diseases are communicated to patients, who although receiving and accepting biomedical care, often rely on their cultural medical system in parallel.

The varying degree of complexity we face when categorizing ethnomedical data into disease categories is nicely illustrated with the 7 colour codes, applied to the 17 chapters of the 2nd edition of the ICPC by the Wonca International Classification Committee (WICC). While symptoms and complaints (green) are the least problematic and define the 17 chapters, the categories of infections (yellow) and neoplasms (blue) pose considerable difficulties in an ethnomedical context (www.kith.no/upload/2705/ICPC-2-English.pdf).

6. Classifying ethnomedical uses – ways forward

The most appropriate way for classifying diseases and remedies based on ethnomedical data largely depends on the research focus. In the following we propose three different approaches based on whether the aim of the study is reflecting the emic perception, comparing medical practices across

cultures or identifying leads for drug development.

I. Research focus: Understanding local and indigenous medical systems

Different populations and ethnic groups have different cultural perceptions and values. Since medicine is defined by the respective culture, during fieldwork ethnopharmacologists and medical anthropologists aim at understanding the classification of diseases and illnesses from within the culture, i.e. from an emic perspective. Consequently, standardized biomedical models might suppress cultural traits and are of limited value to such research endeavours as the focus lies on *ethno*-pharmacology not on ICD-, EBDCS- or ICPC-pharmacology.

II. Research focus: Cross-cultural comparisons and the search for uniqueness and similarities

Uniform, biomedical classification systems can be useful for cross-cultural comparisons of medicinal floras and medical uses. Field ethnopharmacologist interview traditional practitioners, whose diagnostic procedure usually differs greatly from that of a medical doctor. The ICPC classification system is a closer approximation to ethnomedical reality, than the ICD or the EBDCS because the categories are built according to patient's perceptions and are little influenced by clinical medicine. For example, under the umbrella term "Genitourinary System Disorders" the ICD as well as the EBDCS subsume women's medicine, andrology and urological diseases. However, women's medicine and urological problems are particularly broad, well-established categories in ethnomedicine and herbal medicine alike, generally equipped with a specific therapeutical armamentarium. Therefore, it would make more sense to classify women's medicine, andrology and urological diseases separately. The ICPC not only separates women's problems, andrology ("male genital system") and urology, but differentiates also within women's medicine between "pregnancy, childbirth, family planning" and "female genital system and breast" (Table 1; Miller et al., 2009).

For medical ethnobotanists and ethnopharmacologists it should be relatively easy to classify the reported symptoms and patients' complaints as well as the applied remedies with the ICPC by using component **1**) "Symptoms and complaints" and component **3**) "Medication, treatment and procedures" (Table 1). This appears more practicable than applying the ICD or the EBDCS system.

In working towards a classification system suitable for the comparison of ethnomedical records, therefore, we advocate a compromise, suggesting that the ICPC standard be used as a template, which can be modified as required. For example, including a separate category for infectious diseases under "General and Unspecified", together with the symptoms of fever and chills (http://www.kith.no/upload/2705/icpc-2-english.pdf), might be appropriate for a classification system for ethnomedical records. In fact, due to inter-cultural exchange with the western medical system, some endemic infectious diseases such as malaria, dengue, and sleeping sickness are often correctly identified or known by local healers and laypersons since public health care clinics provide screenings and treatments.

The example given above regarding the symptoms "fever and headache", classified by the Popoluca into one category, with the ICPC would need to be classified into "General and Unspecified" (fever, A03) and "Neurological" (headache, N01), while "susto" (fright) would need to be classified under "Psychological" (Acute stress action, P02) with the ICPC (see http://www.kith.no/upload/2705/icpc-2-english.pdf). We furthermore showcase the applicability of the ICPC system for ethnopharmacological records through the classification of therapeutic indications made by Dioscorides (*ex* Matthioli, 1968-1970):

The seeds, the root and the herb of the wild and cultivated fennel (*Foeniculum vulgare* Mill., Apiaceae) are recommended for the production of milk ("genera copiosamente latte"), as a diuretic ("provoca ella l'orina") and to calm pain and problems of the kidney and the bladder ("conferisce a i dolori delle reni, & mali della vesica"; p. 821). Furthermore, *F. vulgare* is indicated for the treatment of [kidney and/or bladder] stones ("rompono le pietre") and for inducing the menses and expelling the afterbirth ("provoca i mestrui", "purga le femine di parto"; p. 821). According to the

ICPC these reports would need to be classified among "Pregnancy, Childbearing, Family Planning" (Breast/lactation symptom/complaint, W19), among "Urological" (Urinary symptom/complaint other, U29; Bladder symptom/complaint other U13; Kidney symptom/complaint U14; and urinary calculus, U95), as "Female Genital" (Menstruation absent/scanty, X05), and again among "Pregnancy, Childbearing, Family Planning" (Post-partum symptom/complaint oth., W18). With the ICD or the EBDCS, however, the above indications would all be classified among "Genitourinary System Disorders".

Moreover, since "the remedy" does not stand at the centre of the ICD, EBDCS and ICPC, the manner of its application is not taken into consideration, but for ethnomedical systems it may be useful to use the mode of application as a key for classification. For example, systemic as well as topical forms of applications for haemorrhoids and varicose veins exist in ethnomedical systems and it may thus be meaningful to either classify use-report or citations among circulatory system or dermatological disorders.

III. Research focus: Bioprospecting - Classifying ethnomedicine into categories as a basis for drug discovery

When selecting local medicines for chemical and pharmacological investigation we generally rely on a detailed description of the application and mode of preparation of the remedies together with an evaluation of the available chemotaxonomic information. In order to direct the local remedies towards the most appropriate biomedical screening systems, a translation of the emic to the etic perspective is required (Leonti and Weckerle, 2015). We argue that the existing biomedical standard classification systems (see sections **3**-**5**) are inadequate for this purpose, because they rely neither on plant-derived pharmacology, nor the associated clinical applications.

We suggest considering the biomedical uses of all approved, plant-derived drugs to develop use-categories suitable for drug discovery. The seminal work by Zhu et al. (2011), which itself is based on Newman and Cragg (2007) surveyed all approved natural product derived drugs, clinical trial and preclinical trial drugs. Below, by way of example, we have classified all clinical and pre-clinical applications of the 225 angiosperm and gymnosperm plant taxa reported by Zhu et al. (2011), which currently contribute to the development of plant-derived drugs into 17 broad use-categories, which by hierarchical taxonomy unite more specific subcategories:

ANT: Antidote (DigiFab, digoxin toxicity) **AND**: Andrology (erectile dysfunction) **CAN**: Cancer (benign prostatic hypertrophy, oncological diseases) **CAR**: Cardiovascular diseases (antiarrhythmic, antihypertensive, antithrombotic, capillary fragility, haemostatic, hypertension, vasodilator) **DER**: Dermatologic disorders (antiacne, antipsoriatic, leukoderma, rubefacient, skin photodamage, vitiligo, vulnerary) **EYE**: Ophthalmic problems (antiglaucoma) **FOO**: Food (antioxidant, flavouring agents, sweetener) **GAS**: Gastrointestinal problems (antihepatotoxic, antiulcer, choleretic, chronic idiopathic constipation, laxative) **GYN**: Gynaecology (abortifacient, oxytocic, uterine haemorrhage) **INF**: Infections (antibacterial, antifungal, antiplasmodial, antiviral, dental plaque inhibitor) **MET**: Metabolic syndromes (Addison's disease, anti-allergic, anti-hyperprolactinaemia, anti-obesity, antityrosinaemia, homocystinuria, immunological - inflammatory and related diseases, lipoprotein disorders) **NER**: Nervous system (ADHD, analeptic, Alzheimer's disease, analgesic, anticholinergic, Parkinson's disease, anxiety and psychosis, cerebral stimulant, major depressive, narcolepsy, neuropathic pain, vascular dementia) **PAR:** Parasites; metazoan (anthelmintic chemotherapy) **POI**: Poisons (insecticide, piscicide) **RES**: Respiratory complaints (antitussive, bronchodilator, expectorant) **SKE**: Skeleto-muscular system (antispasmodic, muscle relaxant, skeletal muscle relaxant) **URO**: Urology (diuretic).

This classification system is derived from biomedical therapy. The specific uses are identical to the ones reported in Zhu et al. (2011) and broadly classified into organ- and therapy-based categories. It

is likely that the future will bring further discoveries of plant-derived products with additional uses, which can eventually be classified into new use categories. In the meantime, the current uses and use-categories reflect the present state of clinical applications and form a solid evidence-base, which can inform both natural product research and, when compared to ethnomedical uses, ethnopharmacology.

7. Conclusions

The answer to the question as to the most appropriate biomedical classification system for ethnomedicine, depends on the context provided by the research purpose. Absolute "one size fits all" standards cannot be appropriate. Focusing on the understanding of local or indigenous medicine warrants an emic or cultural approach (**6.I**), while cross-cultural comparisons would benefit from adopting the ICPC system because it is patient informed, rather than dependent on clinical examinations and the availability of medical diagnostic devices (**6.II**). A biomedical therapy driven classification system (**6.III**) might be instructive for projects focusing on drug discovery from medicinal floras. The most important prerequisite for cross-cultural comparisons is a transparent, coherent and congruent disease classification, based on criteria described in a way that anyone can understand, such as that included here.

Acknowledgements

We are thankful to Antony Challenger for his valuable comments. The research leading to these results has received funding from the People Programme (Marie Curie Actions) of the European Unions 7th Framework programme FP7/ 2007/2013 under REA grant agreement no. PITN-GA-2013-606895 – MedPlant.

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Table 1. Biaxial structure of the International Classification of Primary Care (ICPC)

	Components	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**	**L**	**M**	**N**	**O**	**P**	**Q**
1	Symptoms, complaints																	
2	Diagnostic, screening and preventive procedures																	
3	Medication, treatment and procedures																	
4	Test results																	
5	Administrative																	
6	Referrals and other reasons for encounter																	
7	Diagnosis and diseases																	

A) General and unspecified; **B**) Blood, blood forming organs, lymphatics and spleen; **C**) Digestive; **D**) Eye; **E**) Ear; **F**) Circulatory; **G**) Musculoskeletal; **H**) Neurological; **I**) Psychological; **J**) Respiratory; **K**) Skin; **L**) Endocrine, metabolic and nutritional; **M**) Urology; **N**) Pregnancy, childbirth and family planning; **O**) Female genital system and breast; **P**) Male genital system; and **Q**) Social problems.